Analysis of Proposed 2007-2008 Revisions to the Lightning Launch Commit Criteria for United States Space Launches

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Ascending space vehicles are vulnerable to both natural and triggered lightning. Launches under the jurisdiction of the United States are generally subject to a set of rules called the Lightning Launch Commit Criteria (LLCC). The LLCC protect both the vehicle and the public by assuring that the launch does not take place in conditions posing a significant risk of a lightning strike to the ascending vehicle. Such a strike could destroy the vehicle and its payload, thus causing failure of the mission while releasing both toxic materials and debris. To assure safety, the LLCC are conservative and sometimes they may seriously limit the ability of the launch operator to fly as scheduled even when conditions are benign.

In order to safely reduce the number of launch scrubs and delays attributable to the LLCC, the Airborne Field Mill (ABFM) program was undertaken in 2000 - 2001. The effort was directed to collecting detailed high-quality data on the electrical, microphysical, radar and meteorological properties of thunderstorm-associated clouds. The expectation was that this additional knowledge would provide a better physical basis for the LLCC and allow them to be revised to be both safer and less restrictive. That expectation was fulfilled, leading to significant revisions to the LLCC in 2003 and 2005. The 2005 revisions included the application of a new radar-derived quantity called the Volume Averaged Height Integrated Radar Reflectivity (VAHIRR) in the rules governing flight through anvil clouds.

Analysis of the ABFM data has continued, and two additional revisions to the LLCC were proposed in late 2006 for adoption in 2007 or 2008. One proposal was to apply the VAHIRR concept to debris clouds, and the other was to reduce the "stand-off distances" in the rules for anvil and/or debris clouds. The stand-off distance is the clearance (out side of the cloud) required between the flight path of the vehicle and the edge of a cloud that it is not permissible to fly through. This paper will discuss these proposed changes in the LLCC and the scientific rationale for adopting or rejecting them based on ABFM data.

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